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Impact of organic nutrient management on nutrient uptake and soil health in traditional rice varieties

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Abstract
A field investigation was undertaken during the Kuruvai season (June-September) of 2024 at the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu. The study was laid out in a split-plot design with three replications. The main plot treatments comprised of four traditional rice varieties: Aruvatham Kuruvai, Poongar, Navara, and Ottu Kichilli. The sub-plot treatments included five organic nutrient management practices: farmyard manure (FYM) @ 12.5 t ha^{-1} + 5% jeevamrutham, vermicompost @ 5 t ha^{-1} + 5% jeevamrutham, enriched FYM @ 0.75 t ha^{-1} + 5% jeevamrutham, urban compost @ 10 t $ha^{-1\ 1}$ + 5% jeevamrutham, and an untreated control (no manure). Among the treatments, application of vermicompost @ 5 t ha^{-1} combined with 5% jeevamrutham significantly enhanced the uptake of nitrogen (90.52 kg ha^{-1}), phosphorus (22.58 kg ha^{-1}), and potassium (115.62 kg ha^{-1}), as well as the availability of soil nitrogen (223.0 kg ha^{-1}), phosphorus (24.6 kg ha^{-1}), potassium (283.5 kg ha^{-1}), and organic carbon (0.60%) in the post-harvest soil. Additionally, the highest microbial populations *viz.*,bacteria (38.05 × 10^6 CFU g^{-1}), fungi (14.13 × 10^3 CFU g^{-1}), and actinomycetes (7.01 × 10^4 CFU g^{-1}), were observed under this treatment. Based on these findings, the combination of the traditional variety Poongar with vermicompost @ 5 t ha^{-1} + 5% jeevamrutham proved to be the most effective in improving soil nutrient status and microbial populations after harvest.

Keywords: Jeevamirutham, organic manure, microbial population, traditional rice

1. Introduction

Rice (*Oryza sativa* L.) remains a fundamental staple crop, supplying essential nutrition to nearly one-third of the global population. It is cultivated widely in around 114 countries, encompassing approximately 162.70 million hectares, with a total global production of 520.87 million tonnes and an average productivity of 4.62 tonnes per hectare. However, the dominance of chemically intensive agricultural practices in recent decades has compromised long-term sustainability by prioritizing output over input efficiency, resulting in nutrient depletion of soils. A critical challenge in contemporary agriculture lies in ensuring the production of nutritionally adequate and sufficient food grains to meet the demands of a growing population, without undermining soil fertility, productivity, or quality. In response to these concerns, there is a growing focus on initiating an 'evergreen revolution' that emphasizes organic and natural farming practices to protect environmental integrity and human well-being. Organic agriculture aims to build the resilience and adaptive capacity of farming systems by reinforcing self-regulating mechanisms. This is achieved through the strategic use of functional agro-biodiversity within both soil ecosystems and above-ground environments, thereby minimizing reliance on synthetic inputs (Bueren *et al.*, 2002) [5]. Since organic systems differ substantially from conventional chemical-based agriculture, they require the use of adaptable traditional cultivars that perform reliably and offer yield stability under low-input conditions (Alvin *et al.*, 2019) [1]. In contrast, modern high-yielding varieties are highly dependent on external inputs, including fertilizers and irrigation, and their continuous use has accelerated soil nutrient depletion. Moreover, the imbalanced application of fertilizers has led to a decline in soil health and a significant reduction in soil organic carbon levels, posing a serious threat to agricultural sustainability.

The occurrence of blue baby syndrome in the West Godavari district of Andhra Pradesh has been linked to the excessive use of nitrogen-based fertilizers, especially in rice farming systems

(Mahanta *et al*., 2021) [16]. This alarming event underscores the broader risks associated with chemical agriculture-not only to environmental integrity, soil quality, and biodiversity, but also to human health. In light of these concerns, there is an urgent need to implement sustainable practices in rice cultivation. Transitioning from chemically intensive farming to more ecologically sustainable systems, such as organic agriculture, has become a necessary step forward. The application of organic manures has shown promise in mitigating productivity decline by addressing deficiencies in secondary and micronutrients, while also positively influencing the soil's physical and biological characteristics. Assessing the performance of traditional rice varieties under organic cultivation is crucial to promote their adoption in organic farming systems. These indigenous varieties exhibit significant nutraceutical and functional food potential and possess inherent resilience to biotic and abiotic stresses, thereby lowering input costs for farmers. Notably, traditional rice cultivars often outperform high-yielding varieties under low-input conditions and demonstrate superior tolerance to drought and waterlogging (Ashraf and Subbalakshmi, 2017) [3]. Plants' nutritional requirements can be effectively met through organic inputs such as farmyard manure (FYM), vermicompost, and foliar organic formulations (Debbarma *et al*., 2015) [9]. Among these, FYM, vermicompost, and enriched FYM are particularly beneficial, as they contribute substantial organic matter and essential nutrients, thereby enhancing soil fertility and microbial activity. Against this backdrop, the present study was undertaken to investigate the impact of organic manures on the chemical and biological attributes of soil under the cultivation of traditional rice varieties.

2. Materials and Methods

A field investigation was carried out during the Kuruvai season (June-September) of 2024 at the Experimental Farm of the Department of Agronomy, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu, to evaluate the impact of organic manures on post-harvest soil properties under traditional rice cultivation. The experimental site is situated in the southern part of India, geographically positioned at 11° 24' N latitude and 79° 44' E longitude, with an elevation of approximately 5.79 meters above mean sea level. The soil type at the location was classified as clay loam in texture. Prior to the experiment, composite soil samples were collected and analyzed to determine baseline physical and chemical characteristics. The soil exhibited a neutral pH of 7.7. The initial soil fertility assessment revealed low levels of available nitrogen (235.4 kg ha^{-1}), while available phosphorus (20.8 kg ha^{-1}) and potassium (278.0 kg ha^{-1}) were found to be in the medium range. The organic carbon content was recorded at 0.44%.The experiment was designed using a split-plot layout with three replications. The main plot treatments included four traditional rice varieties: Aruvatham Kuruvai, Poongar, Navara, and Ottu Kichilli. The sub-plot treatments comprised five organic manure combinations: (i) Farmyard manure (FYM) @ 12.5 t ha^{-1} + 5% Jeevamrutham, (ii) Vermicompost @ 5 t ha^{-1} + 5% Jeevamrutham, (iii) Enriched FYM @ 0.75 t ha^{-1} + 5% Jeevamrutham, (iv) Urban compost @ 10 t ha^{-1}+ 5% Jeevamrutham, and (v) Control (no organic input). Plant samples were collected at harvest to assess nutrient uptake. The samples were oven-dried at 80 ± 5°C, ground using a Willey mill, and passed through a 20-mesh sieve. Nitrogen content was estimated using the Micro-Kjeldahl method as described by Yoshida *et al*. (1976) [29], while phosphorus and potassium were determined following the triple acid digestion method outlined by Jackson (1973) [12], using a photoelectric colorimeter and flame photometer, respectively. The nutrient concentrations (%) obtained from analysis were multiplied by the corresponding treatment-wise dry matter production (DMP) to compute total nutrient uptake, expressed in kg ha^{-1}.

$$\text{Nutrient uptake} = \frac{\text{Percentage nutrient} \times \text{Total dry matter production (kg ha}^{-1})}{100}$$

To determine the available nutrient status of the soil, composite surface soil samples (0-15 cm depth) were collected from each treatment plot at the end of the experiment. The samples were shade-dried, passed through a 0.2 cm sieve, and used for subsequent analyses. Available nitrogen in the soil was estimated using the alkaline potassium permanganate method as outlined by Subbiah and Asija (1956) [26]. Available phosphorus (0.5 M $NaHCO_3$ extractable) was determined following the method of Olsen *et al*. (1954) [23], while available potassium was measured using flame photometry as per Stanford and English (1949) [25]. Soil organic carbon content was analyzed through chromic acid wet digestion, following the procedure described by Walkley and Black (1934) [27].The microbial population in post-harvest soil was assessed using the serial dilution plate count technique. Total bacterial populations were estimated at a 10^{-6} dilution using nutrient agar medium (Collings and Lyne, 1968) [7]. Fungal populations were enumerated from 10^{-3} dilutions using Martin's Rose Bengal medium (Martin, 1950) [17], and actinomycetes were quantified from 10^{-4} dilutions using Kenknight's agar medium (Kenknight and Muncie, 1939) [14]. All data related to soil and plant analyses were statistically analyzed using analysis of variance (ANOVA) as recommended by Gomez and Gomez (1991) [11] to evaluate the significance of treatment effects on various parameters. Statistical analyses were performed using Microsoft Excel (Microsoft Corporation, USA)

3. Results and Discussion

3.1 Nutrient uptake

The data on nutrient uptake (kg ha^{-1}) by rice are presented in Table 1. The uptake of nitrogen (N), phosphorus (P), and potassium (K) was significantly influenced by the application of organic manures across the traditional rice varieties studied. Among the cultivars, Poongar (M_2) recorded the highest uptake of nitrogen, phosphorus, and potassium, with values of 81.41, 19.11, and 105.20 kg ha^{-1}, respectively. The treatment comprising the application of vermicompost at 5 t ha^{-1} in conjunction with 5% Jeevamrutham (S_2) proved most effective among the organic nutrient management options, registering the highest uptake levels of nitrogen (82.86 kg ha^{-1}), phosphorus (20.25 kg ha^{-1}), and potassium (108.16 kg ha^{-1}). Moreover, a significant synergistic interaction was observed between the traditional rice varieties and the applied organic nutrient management strategies. The treatment combination M_2S_2 (Poongar with vermicompost @ 5 t ha^{-1} + 5% Jeevamrutham) achieved the maximum nutrient uptake, 90.52 kg N ha^{-1}, 22.58 kg P ha^{-1}, and 115.62 kg K ha^{-1}. Nitrogen is a critical nutrient during the early stages of crop development, its uptake was strongly influenced by its availability in the soil. The presence of Indole Acetic Acid (IAA) likely promoted the development of adventitious roots from the stem base, enhancing root activity and facilitating better nutrient absorption. These findings are consistent with those of Nandan (2006) [20]. Phosphorus plays an essential role in various physiological and biochemical processes, as it is a component of key energy molecules such as ATP, ADP, and NADP. It is involved in photosynthesis, carbohydrate metabolism, amino acid and fat metabolism, glycolysis, and biological oxidation. The positive impact of vermicompost on phosphorus uptake may be attributed to its facilitative role in improving the availability of N, P, and K in rice, corroborating the findings of Dravid and Biswas (2006) [10]. Potassium is essential for various physiological processes in plants, including enzyme activation, carbohydrate and protein formation, and photosynthetic efficiency. It also aids in maintaining stomatal regulation and ensures effective movement of water, sugars, and nutrients throughout the plant. The beneficial effects of organic manure application, especially vermicompost, contributed to an increase in exchangeable potassium, improving its availability to plants. This can be linked to enhanced cation exchange capacity (CEC) of the soil. These results align with those reported by Meek *et al*. (2009) [18] and Yamagatha (2009) [28], who noted improved potassium uptake due to reduced losses and fixation in paddy soils.Jeevamrutham, being rich in soil-beneficial microbial populations such as nitrogen-fixing bacteria, phosphate-solubilizing microbes, and Lactobacillus species, may have contributed to improved nutrient availability. This could be due to the incorporation of garden soil in its preparation, as highlighted by Balakumar *et al*. (2021) [4]. Conversely, the lowest nitrogen uptake was observed in M_1S_5 (Aruvatham Kuruvai under control), likely due to limited nutrient availability in untreated plots. Notably, nutrient uptake is directly influenced by biomass production, and higher biomass accumulation reflects increased nutrient absorption. These results are consistent with the findings of Chandra *et al*. (2019) [6] and Nazir *et al*. (2022) [22].

3.2 Post-harvest soil available nutrients:

Organic nutrient management practices significantly influenced the availability of soil nutrients in the post-harvest phase. The results pertaining to available nitrogen, phosphorus, and potassium (NPK) in soil are presented in Table 2. Among the traditional rice cultivars, Aruvatham Kuruvai (M_1) exhibited significantly higher levels of available nitrogen (209.2 kg ha^{-1}), phosphorus (20.6 kg ha^{-1}), and potassium (275.7 kg ha^{-1}). Regarding sub-plot treatments, the application of vermicompost at 5 t ha^{-1} along with 5% Jeevamrutham (S_2) resulted in the highest concentrations of available nitrogen (219.8 kg ha^{-1}), phosphorus (22.9 kg ha^{-1}), and potassium (281.3 kg ha^{-1}). The interaction between main and sub-plot treatments exhibited statistical significance. The combination of M_1S_2 (Aruvatham Kuruvai with vermicompost @ 5 t ha^{-1} + 5% Jeevamrutham) registered the maximum values for available nitrogen (223.0 kg ha^{-1}), phosphorus (24.6 kg ha^{-1}), and potassium (283.5 kg ha^{-1}). The comparatively higher post-harvest nutrient levels in Aruvatham Kuruvai (M_1) may be attributed to its lower nutrient uptake, resulting in reduced vegetative growth and yield. On the contrary, Poongar (M_2) exhibited the lowest residual soil nutrient levels, likely due to greater nutrient uptake by the crop. This enhanced uptake may have contributed to increased plant height, tiller number, leaf area, biomass production, and ultimately, higher grain yield, as reported by Solaiappan *et al*. (2002) [24]. Among the organic treatments, S_2 (Vermicompost + Jeevamrutham) consistently improved soil nutrient status after harvest. The significant enhancement in post-harvest N, P, and K availability can be attributed to the role of vermicompost in accelerating the mineralization of both native and applied nutrients by fostering favorable microbial and chemical soil conditions. Since not all absorbed nutrients are utilized by the crop, the residual fraction enhances the nutrient pool of the soil post-harvest. The increase in available nitrogen may be due to intensified microbial activity, which facilitated the transformation of organically bound nitrogen into its inorganic forms, thereby enriching the soil. Vermicompost, being rich in phosphorus, likely enhanced soil P availability either through decomposition and subsequent release of phosphorus from organic residues or by increasing soluble organic acids that improve phosphate desorption from soil colloids. Similarly, potassium availability was improved due to the contribution of K_2O from vermicompost and its influence on clay-organic matter interactions, which expanded the pool of exchangeable potassium. Additionally, vermicompost minimizes nutrient loss via leaching, further enhancing nutrient retention. These findings are in agreement with those reported by De Fatima Esteves *et al*. (2020) [8].

3.3 Organic carbon (%)

The observations related to soil organic carbon content (%) are presented in Table 4. Post-harvest analysis revealed that among the traditional rice varieties, there was no statistically significant difference in organic carbon content. However, among the organic nutrient management treatments, S_2 (vermicompost @ 5 t ha^{-1} + 5% Jeevamrutham) recorded the highest organic carbon level at 0.47%, while the lowest value of 0.41% was observed in S_5 (control - no manure). The interaction effect between rice varieties and nutrient management treatments was also found to be non-significant. The increased organic carbon content under S_2 treatment could be attributed to enhanced microbial activity and improved decomposition of organic residues, leading to greater incorporation of organic matter into the soil (Meena *et al*., 2018; Nayak *et al*., 2020) [19, 21]. Furthermore, the elevated organic carbon levels in the vermicompost-treated plots may be due to the buildup of humus and a higher microbial biomass facilitated by the combined effect of vermicompost and crop residue incorporation.

3.4. Microbial population

Table 3 presents the data on soil microbial populations. The traditional rice varieties used as main plot treatments did not result in any significant differences in microbial counts in the post-harvest soil. However, the use of different organic nutrient amendments had a notable effect, significantly enhancing the populations of key soil microbes such as bacteria, fungi, and actinomycetes. Among the various nutrient management practices, the S2 treatment—comprising vermicompost at 5 t ha^{-1} combined with 5% Jeevamrutham—exhibited the highest microbial populations, with bacterial counts reaching 38.05 × 10^6 CFU g^{-1}, fungal populations at 14.13 × 10^3 CFU g^{-1}, and actinomycetes at 7.01 × 10^4 CFU g^{-1}. Conversely, the control treatment (S5), which did not receive any organic inputs, recorded the lowest microbial activity, with bacteria, fungi, and actinomycetes measuring 21.45 × 10^6 CFU g^{-1}, 7.87 × 10^3 CFU g^{-1}, and 3.01 × 10^4 CFU g^{-1}, respectively. The interaction between main plot and sub-plot factors did not exhibit statistical significance. The increased microbial populations observed in S_2-treated plots were consistent with the higher organic carbon content recorded in the same treatment. This enhancement can be attributed to the synergistic effect of vermicompost and Jeevamrutham, which contributed to increased humus levels, providing both energy and nutrients necessary for microbial proliferation. Vermicompost's porous structure and nutrient-rich composition create a conducive environment for microbial growth. Organic amendments such as vermicompost enhance microbial diversity and activity by enriching the soil with organic matter and nutrients, and by offering physical conditions favourable to microbial colonization (An and Tang, 2017) [2]. Similar findings on the beneficial effects of vermicompost on microbial populations have been reported by Lumgmuana *et al.* (2016) [15] and Kamaleshwaran and Elayaraja (2021) [13].

Table 1: Effect of organic nutrient management on the nutrient uptake (kg ha^{-1}) of traditional rice varieties at harvesting stage

	Nitrogen uptake (kg ha^{-1})					Phosphorous uptake (kg ha^{-1})					Potassium uptake (kg ha^{-1})				
Main / Sub	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	69.32	83.55	70.84	81.33	76.26	16.55	20.04	17.06	19.68	18.33	92.95	110.69	95.28	108.44	101.84
S_2	75.23	90.52	76.85	88.84	82.86	18.20	22.58	18.57	21.66	20.25	100.02	115.62	103.54	113.47	108.16
S_3	67.48	80.11	68.34	78.36	73.57	14.96	19.37	15.82	18.82	17.24	89.46	106.52	91.87	104.32	98.04
S_4	72.85	87.02	73.96	85.15	79.75	17.42	21.14	17.64	20.85	19.26	97.64	112.87	99.87	111.79	105.54
S_5	52.14	65.84	56.74	60.28	58.75	9.52	12.42	10.84	11.85	11.16	66.52	80.32	70.58	75.48	73.23
Mean	67.40	81.41	69.35	78.79		15.33	19.11	15.99	18.57		89.32	105.20	92.23	102.70	

	Main	Sub	M at S	S at M		Main	Sub	M at S	S at M		Main	Sub	M at S	S at M
S.Ed	0.74	0.63	1.34	1.25	S.Ed	0.17	0.21	0.42	0.43	S.Ed	0.49	0.70	1.34	1.40
CD (p=0.05)	1.80	1.27	2.73	2.55	CD (p=0.05)	0.41	0.44	0.85	0.87	CD (0.05)	1.20	1.42	2.73	2.84

Main plots: M_1 - Aruvatham kuruvai, **M_2** - Poongar, **M_3** - Navara, **M_4** - Ottu kichili.
Sub plots: S_1 - FYM @ 12.5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_2** -Vermicompost @ 5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_3** - Enriched FYM @ 0.75 t ha^{-1} + Jeevamirutha @ 5% on 15, 30 and 45 DAT, **S_4** - Urban Compost @ 10 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_5** - No manure (Control)

Table 2: Effect of organic nutrient management on the post-harvest soil available nutrient (kg ha^{-1}) in traditional rice varieties

	Available Nitrogen (kg ha^{-1})					Available Phosphorus (kg ha^{-1})					Available potassium (kg ha^{-1})				
Main / Sub	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	217.6	204.2	209.5	207.5	209.7	21.6	18.5	19.5	18.6	19.5	278.5	269.5	279.7	275.7	275.8
S_2	223.0	215.0	221.1	220.2	219.8	24.6	21.2	23.6	22.2	22.9	283.5	279.6	281.7	280.5	281.3
S_3	197.8	194.7	197.5	195.4	196.4	18.4	16.9	17.9	16.9	17.5	276.2	263.6	273.6	261.9	268.8
S_4	218.7	211.7	219.7	215.3	216.3	22.1	20.1	22.1	21.3	21.4	280.3	276.3	258.7	277.6	273.2
S_5	189.0	184.4	187.5	186.1	186.8	16.5	14.8	15.9	15.2	15.6	260.1	254.1	262.5	256.3	258.3
Mean	209.2	202.0	207.1	204.9		20.6	18.3	19.8	18.8		275.7	268.6	271.2	270.4	

	Main	Sub	M at S	S at M		Main	Sub	M at S	S at M		Main	Sub	M at S	S at M
S.Ed	0.44	0.56	1.09	1.11	S.Ed	0.21	0.17	0.37	0.35	S.Ed	0.56	0.73	1.41	1.45
CD (p=0.05)	1.08	1.12	2.22	2.27	CD (p=0.05)	0.51	0.36	1.09	0.71	CD (p=0.05)	1.37	1.48	2.88	2.96

Main plots: M_1 - Aruvatham kuruvai, **M_2** - Poongar, **M_3** - Navara, **M_4** - Ottu kichili.
Sub plots: S_1 - FYM @ 12.5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_2** -Vermicompost @ 5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_3** - Enriched FYM @ 0.75 t ha^{-1} + Jeevamirutha @ 5% on 15, 30 and 45 DAT, **S_4** - Urban Compost @ 10 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_5** - No manure (Control)

Table 4: Effect of organic nutrient management on the soil microbial population (Bacteria 10^6, Fungi 10^3 and Actinomycetes 10^4) in traditional rice varieties

	Bacterial population (x10^6 CFU g^{-1})					Fungal population (x10^3 CFU g^{-1})					Actinomycetes population (x10^4 CFU g^{-1})				
Main / Sub	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	33.84	34.12	32.48	33.94	33.60	11.85	12.66	11.74	12.28	12.13	5.39	5.62	5.14	5.42	5.39
S_2	37.66	38.85	37.45	38.24	38.05	13.95	14.65	13.54	14.38	14.13	6.91	7.32	6.68	7.14	7.01
S_3	28.74	30.58	28.30	29.55	29.29	11.14	11.32	11.02	11.20	11.17	3.95	4.59	3.88	4.18	4.15
S_4	34.26	35.28	34.20	34.89	34.66	12.85	13.35	12.68	13.18	13.02	5.86	6.19	5.84	6.04	5.98
S_5	20.84	22.68	20.26	22.03	21.45	7.48	8.54	7.25	8.21	7.87	2.98	3.25	2.68	3.12	3.01
Mean	31.07	32.30	30.54	31.73		11.45	12.10	11.25	11.85		5.02	5.39	4.84	5.18	

	Main	Sub	M at S	S at M		Main	Sub	M at S	S at M		Main	Sub	M at S	S at M
S.Ed	0.15	0.41	0.74	0.81	S.Ed	0.05	0.15	0.28	0.30	S.Ed	0.03	0.07	0.12	0.13
CD (p=0.05)	NS	0.83	NS	NS	CD (p=0.05)	NS	0.31	NS	NS	CD (p=0.05)	NS	0.14	NS	NS

Main plots: M_1 - Aruvatham kuruvai, **M_2** - Poongar, **M_3** - Navara, **M_4** - Ottu kichili.
Sub plots: S_1 - FYM @ 12.5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_2** -Vermicompost @ 5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_3** - Enriched FYM @ 0.75 t ha^{-1} + Jeevamirutha @ 5% on 15, 30 and 45 DAT, **S_4** - Urban Compost @ 10 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, **S_5** - No manure (Control)

Table 4: Effect of organic nutrient management on organic carbon content of soil (%) in traditional rice varieties

Main Sub	M_1	M_2	M_3	M_4	Mean
S1	0.45	0.44	0.45	0.45	0.45
S_2	0.46	0.47	0.46	0.47	0.47
S_3	0.42	0.43	0.42	0.42	0.42
S_4	0.45	0.46	0.45	0.46	0.46
S_5	0.41	0.42	0.41	0.41	0.41
Mean	0.44	0.44	0.44	0.44	

	Main	Sub	M at S	S at M
S.Ed	0.001	0.007	0.013	0.014
CD (p-=0.05)	NS	0.01	NS	NS

Main plots: $\mathbf{M_1}$ - Aruvatham kuruvai, $\mathbf{M_2}$ - Poongar, $\mathbf{M_3}$ - Navara, $\mathbf{M_4}$ - Ottu kichili.
Sub plots: $\mathbf{S_1}$ - FYM @ 12.5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT,
$\mathbf{S_2}$ -Vermicompost @ 5 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, $\mathbf{S_3}$ - Enriched FYM @ 0.75 t ha^{-1} + Jeevamirutha @ 5% on 15, 30 and 45 DAT, $\mathbf{S_4}$ - Urban Compost @ 10 t ha^{-1} + Jeevamirutham @ 5% on 15, 30 and 45 DAT, $\mathbf{S_5}$ - No manure (Control)

Conclusion
The results of the present investigation distinctly reveal that the combined application of vermicompost @ 5 t ha^{-1} and 5% jeevamrutham, administered at 15, 30, and 45 days after transplanting (DAT), significantly improved nutrient uptake, enhanced the availability of soil nutrients, and promoted higher microbial populations in traditional rice varieties. This integrated organic nutrient management approach proved effective in stimulating soil microbial activity and improving soil health, thereby presenting a sustainable and eco-friendly strategy for boosting productivity in traditional rice.

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